Mixed Reality for Prostate Fresh Tissue Procurement

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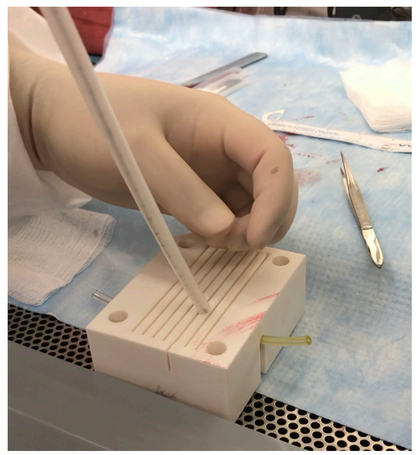
Background

Prostate cancer is the second most common cancer type after skin cancer, and one of the leading causes of cancer death in men living in the United States. Comprehensive research of prostate cancerous tissue on the molecular level provides the basis for improved diagnosis, accurate prognosis evaluation, and treatment planning. Therefore, there is an increased demand for more effective prostate fresh tissue procurement methods that do not interfere with subsequent histopathological evaluations.

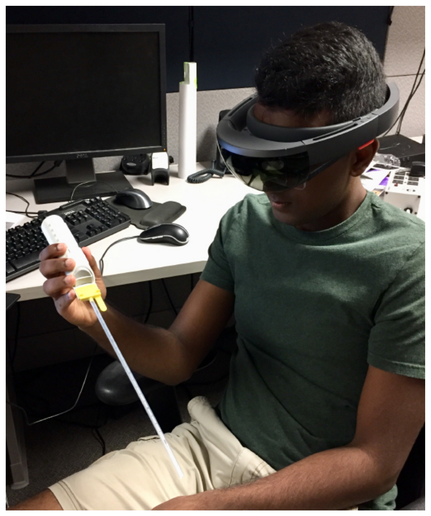
Currently, we utilize a patient-specific prostate mold for preserving *in-vivo* orientation and shape of the gland. The biopsy needle is guided through a channel on a side of the mold. It is a time-consuming task to identify the optimum entry point of the needle, given the constraint of the channel angle for the 3D printing process.

In this work we asses the feasibly of mixing a virtual reality with a physical world utilizing Mixed Reality (MR) methods for fresh tissue procurement. The goal is to use a HoloLens goggles developed by Microsoft to visualize a 3D hologram lesion within a physical world prostate gland and to provide visual guidance for the biopsy needle.



Guided biopsy needle fresh tissue procurement using a patient specific prostate mold.

Methods



Visualizing a 3D biopsy needle hologram utilizing HoloLens.

Screenshot of the Unity environment: 3D biopsy needle hologram overlays the biopsy needle in a physical world.

- An Android application, based on the Vuforia package, was developed to generate a 3D hologram of an object by scanning it with the phone camera. The 3D hologram is saved in .od file format, which is proprietary to the Vuforia SDK.
- Development of an MR application. The HoloLens API was used for importing and visualizing of a 3D hologram of the biopsy needle in the MR environment. The application was developed using cross-platform Unity engine and Visual Studio software.
- The 3D hologram of the needle was co-registered with the biopsy needle in the physical world.
- The 3D model of the patient-specific mold base was generated using the CAD software SolidWorks while the 3D models of the prostate and tumor lesion were reconstructed from the volumes of interest (VOIs) outlined by the trained radiologist on the T2W MR images.

Future Work

- Improve object recognition script for an accurate registration of the 3D holograms to the physical world objects.
- Implement tracking algorithm with high precision co-registration capabilities between a biopsy needle in a physical world and its 3D digital model to assure accurate positioning of the biopsy needle within the prostate gland.

Screenshot of the Unity environment: 3D biopsy needle hologram overlays the biopsy needle in physical world and a 3D holograms of the patient-specific mold supporting prostate with a tumor.